

Claims

1. An apparatus for screening a compound by monitoring the interactions of said compound with a specimen having fluorophore loaded target cells, said apparatus comprising:
 - 5 an optical illumination unit comprising at least two light sources, wherein light from said at least two light sources is directed to illuminate said specimen;
 - a fluorescence separation unit coupled to receive emitted light from said specimen and separate at least three emitted wavelengths of light from said emitted light;
 - and
 - 10 a fluorescence detection unit coupled to said fluorescence separation unit to count photons emitted by said at least three wavelengths of emitted light.
2. The apparatus of claim 1 wherein said optical illumination unit further comprises a light processing unit coupled to said laser beam light source, said light
15 processing circuit altering the qualities of a light beam from said first laser beam light source.
3. The apparatus of claim 1 further comprising at least two dichroic mirrors coupled to said optical illumination unit.
- 20 4. The apparatus of claim 1 wherein said fluorescence separation unit further comprises at least three dichroic polarizer-analyzers and at least three band-limited interference filters.

5. The apparatus of claim 1 further comprising at least three photo-detectors coupled to receive said at least three wavelengths of emitted light.
6. An apparatus for screening a compound by monitoring the interactions of said compound with a specimen having fluorophore-loaded target cells, said apparatus comprising:
- an optical illumination unit comprising at least two light sources which generate polarized light;
- a plurality of filters coupled to said optical illumination unit to co-axially illuminate said specimen;
- a fluorescence separation unit comprising at least two filters to direct and separate at least three emitted wavelengths of light from light emitted from said specimen and couple each wavelength of light of said at least three emitted wavelengths of light to a separate dichroic polarizer-analyzer, and; and
- a fluorescence detection unit comprising at least three detectors, each of said detectors comprising a photo-detector.
7. The apparatus of claim 6 further comprising a light processing unit coupled to a laser beam light source, said light processing circuit altering the qualities of a light beam from said laser beam light source.
8. The apparatus of claim 6 further comprising an inverted microscope coupled to receive light emitted from said specimen.

25

9. The apparatus of claim 6 further comprising a computer coupled to said fluorescence detection unit.
10. An apparatus for screening a compound by monitoring its interactions with a specimen having fluorophore-loaded target cells, said apparatus comprising:
- 5 a first light source;
 - a second light source;
 - a first dichroic mirror coupled to receive light from said first light source and said second light source;
 - 10 a second dichroic mirror coupled to receive light from said first light source which is passed by said first dichroic mirror and coupled to receive light from said second light source which is deflected by said first dichroic mirror, said second dichroic mirror being coupled to deflect said light from said first light source and said second light source to said specimen and pass light emitted from said specimen;
 - 15 a third dichroic mirror that deflects a first wavelength of light from said light emitted from said specimen;
 - a fourth dichroic mirror that deflects a second wavelength of light from said light emitted from said specimen and passes a third wavelength of light from said specimen;
 - 20 at least three dichroic polarizer-analyzers and at least three band-limited interference filters; and
 - at least three photo-detectors coupled to receive outputs associated with said first, second and third wavelengths of light.
- 25 11. The apparatus of claim 10 further comprising a light processing unit.

12. The apparatus of claim 10 further comprising an inverted microscope coupled to receive light emitted from said specimen.
- 5 13. The apparatus of claim 10 further comprising a computer coupled to receive outputs of said at least three photo-detectors.
14. An apparatus for screening a compound by monitoring its interactions with a specimen having fluorophore loaded target cells developing a profile of target cells in a specimen, said apparatus comprising:
- 10 an argon-ion laser;
a xenon light source;
a first dichroic mirror coupled to receive light from said argon-ion laser and said xenon light source;
- 15 a second dichroic mirror coupled to receive light from said argon-ion laser which is passed by said first dichroic mirror and coupled to receive light from said xenon light source which is deflected by said first dichroic mirror, said second dichroic mirror being coupled to deflect said light from said argon-ion laser and said xenon light source to said specimen and pass light emitted from said specimen;
- 20 a third dichroic mirror that deflects a first wavelength of light from said light emitted from said specimen;
a fourth dichroic mirror that deflects a second wavelength of light from said light emitted from said specimen and passes a third wavelength of light from said specimen;

at least three dichroic polarizer-analyzers, at least three band-limited interference filters for their respective emission wavelengths;

at least three photo-detectors coupled to receive the outputs associated with said first, second and third wavelengths of light; and

5 a computer coupled to receive outputs of said at least three photo-detectors.

15. A method of screening a compound by monitoring the interactions of said compound with a specimen having fluorophore loaded target cells, said method comprising the steps of:

10 coupling a first light source to said specimen to illuminate said specimen;
coupling a second light source to said specimen to illuminate said specimen;
separating at least three wavelengths of light emitted from said specimen, and
detecting photons from said three emitted wavelengths of light.

15 16. The method of claim 15 further comprising a step of filtering said light from said laser beam light source.

17. The method of claim 15 further comprising a step of expanding said light from said laser beam light source.

20

18. The method of claim 15 further comprising a step of focusing light from said first light source and said second light source on said specimen.

19. The method of claim 15 further comprising a step of filtering said first, second
25 and third wavelengths of light.

20. The method of claim 15 further comprising a step of generating a count of photons from said first, second and third wavelengths of light.
- 5 21. The method of claim 15 further comprising a step of generating a response profile of said target cells.
22. A method of screening a compound by monitoring the interactions of said compound with a specimen having fluorophore loaded target cells, said method
- 10 comprising the steps of:
- coupling an argon-ion laser to said specimen to illuminate said specimen;
 - coupling a xenon light source to said specimen to co-axially illuminate said specimen;
 - separating at least three wavelengths of light emitted from said fluorophore-
 - 15 loaded specimen,
 - detecting photon from said three emitted wavelengths of light;
 - generating a count of photons from said first, second and third wavelengths of light; and
 - generating a response profile of said target cells.
- 20
23. A method for identifying a pharmaceutically active compound, said method comprising the steps of:
- interacting a compound with a specimen containing at least three chemicals of interest;

simultaneously detecting the activities of said at least three chemicals from optical signals emitted from the specimen.

24. A system for two-dimensional high-throughput kinetic scanning of a multi-
5 well plate, comprising:

One or more sources of light;

two perpendicular acousto-optical modulators spaced so that each is within the range of deflection of the first order beams of the other modulator;

a convergence lens responsive to the source of light;

- 10 an optical fiber array responsive to the source of light

a system for analyzing the light collected from the multi-well plate; and

a computer system to operate the scanning system.

25. A light source for use in an apparatus for screening a compound by monitoring its interactions with a specimen having fluorophore loaded target cells, said light
15 source comprising:

one or more light emitting diodes which emit light at differing wavelengths;

an apparatus for integrating the light emitted by the diodes into a single output beam;

- 20 an apparatus for applying a modulation waveform function to the single output beam;

an apparatus for changing the frequency of the modulation waveform function;

an apparatus for changing the amplitude of the modulation waveform function;

an apparatus for changing the average intensity of the modulation waveform function;

an apparatus for changing the waveform of the modulation waveform function
to a sine wave, a square wave, or a pulse; and
an apparatus for changing the duration of the pulse in the modulation
waveform function.